The Impact of Residential Medication Management Reviews (RMMRs) on Medication Regimen Complexity

Original article

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Letter to the editor

Editor

CMRO

Dear Sir/ Madam

Sub: Manuscript submission to CMRO

On behalf of my co-authors, I would like to submit the attached manuscript entitled, "*The Impact of Residential Medication Management Review (RMMRs) on Medication Regimen Complexity"* for consideration for possible publication in the Original Research Article category of CMRO.

This paper has not been published or accepted for publication nor has been published in whole or part elsewhere. I attest to the fact that all authors listed on the title page have read the manuscript, agree to the validity and legitimacy of the data and its interpretation, and agree to its submission.

We believe this paper may be suitable to be published in your esteemed journal focusing on pharmacy practice and patient care. In our study we examined the Residential Medication Management Review service to determine its impact on medication regimen complexity using the Medication Regimen Complexity Index in residents of aged care facilities.

I hope the reviewing process finds the manuscript acceptable for publication in your journal and look forward to hearing the outcome of the peer review. If I can provide any additional information, please contact me at Ronald.Castelino@sydney.edu.au

Sincerely Yours,

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Abstract

Background

Residential Medication Management Reviews (RMMRs) are routinely conducted in Australian residential aged care facilities (ACFs) to improve medication outcomes in elderly residents. Medication regimen complexity has been associated with poor patient outcomes. However, little is known about the impact of medication reviews on medication regimen complexity in older people living in ACFs.

Objectives

The primary objective of this study was to investigate the impact of RMMRs on medication regimen complexity, as assessed by a validated measure.

Methods

Retrospective analysis of RMMRs pertaining to 285 aged care residents aged ≥65 years in Sydney, Australia. Medication regimen complexity was measured using the Medication Regimen Complexity Index (MRCI) at baseline, after pharmacists' recommendations (assuming that all of the pharmacists' recommendations were accepted by the General Practitioner (GP)), and after the actual uptake of pharmacists' recommendations by the GP. Differences in the regimen complexity was measured using the Wilcoxon sign rank test.

Results

Pharmacists made 764 recommendations (average 2.7 recommendations per RMMR), of which 569 (74.5%) were accepted by GPs. The median MRCI at baseline in the sample was 25.5 (IQR= 19.0-32.5). No statistically significant differences were demonstrated in the MRCI scores after pharmacists' recommendations (P=0.53) or after GPs' acceptance of these recommendations (p=0.07) compared to the baseline.

Conclusion

Our study revealed high acceptance of pharmacists' recommendations by GPs. This suggests that RMMRs are useful for identifying and resolving drug-related

issues among residents of ACFs. However, our study failed to show a significant effect of RMMRs in reducing the medication regimen complexity, as measured by the MRCI. Further studies are needed to establish the association of medication regimen complexity and clinical outcomes in residents of ACFs.

Introduction

Older people (≥65 years) are accounting for an increasing share of the population worldwide [1], and Australia is no exception. In 2013, 14% of the Australian population were aged ≥65 years and 1.9% were aged ≥85 years. This proportion is projected to increase to approximately 21% and 4.2%, respectively, by 2053. Such an increase in the aging population brings major challenges to the health care system as older people have higher health care utilization and associated costs [2].

The number of health conditions is higher in older age groups and, consequently, this population are prescribed a large number of medications [3]. Prescribing in older people is complex because of the age-related changes in body composition and multiple pathologies [4, 5]. In older people with multiple comorbidities, prescribing must be balanced between limiting the number of medications and using all medications that may be beneficial [6]. Previous studies have reported that residents of aged-care facilities (ACFs) are prescribed significantly more medications than people living in the community [7]. Over 90% of the residents of ACFs are subject to polypharmacy, defined as the concomitant use of 5 or more drugs, with a reported average of 9.75 medicines per resident [8].

In general, as the number of medications increase, the medication regimen becomes more complex. However, it is important to note that the number of medications taken by a patient is only one element of regimen complexity. Other elements that are associated with regimen complexity include dosage forms, dosing frequencies, and specific dosing instructions [9]. Previous studies have associated high medication regimen complexity with lower medication adherence [10, 11] and an increased risk of hospital readmission [12]. While medication adherence is less problematic in this environment, measuring the complexity of medication regimen is an important aspect of the care of ACF residents as it may add to staff workloads and these residents are reported to have a generally high medication regimen complexity [13, 14].

In Australia, Residential Medication Management Reviews (RMMRs) are a nationally remunerated service available to all permanent residents of government funded ACFs. The RMMR service is a key strategy for achieving quality use of medicines and involves an accredited pharmacist, who has access to clinical data, medication lists and diagnoses, visiting the resident and assessing the resident's medications to identify medication-related issues. The accredited pharmacist then makes recommendations to the resident's physician to resolve any medication-related issues [15]. Although previous studies have shown that medication reviews performed by pharmacists can improve medication use by identifying and resolving drug-related problems in residents of ACFs [16, 17], there is limited evidence of the impact of RMMRs on simplifying medication regimens.

The aim of this study was to investigate the impact of RMMR on simplifying medication regimen complexity in Australian ACF residents by using the Medication Regimen Complexity Index (MRCI). The specific objectives of this study were to: 1) determine the MRCI scores in older people living in ACFs; 2) evaluate the potential impact of recommendations made by accredited pharmacists on MRCI scores; and 3) evaluate the impact of the RMMR services on MRCI scores after general practitioner (GP) uptake of pharmacists' recommendations.

2 Methods

2.1 Ethics and Study Population

This was a retrospective study of de-identified RMMR reports with GP outcomes pertaining to 285 residents living in residential ACFs in Australia. The RMMR reports were collected from a single RMMR service provider (Meditrax, Sydney, New South Wales, Australia) and were conducted between August 2011 and December 2012. Accredited pharmacists compiled RMMR reports, which included a comprehensive medication history, current medical diagnoses, actual

medications taken, clinical pathology results, pharmacists' findings and recommendations. GP feedback on the RMMR reports and reconciled medication charts for each resident determined whether pharmacists' recommendations to resolve any problems were accepted or not. Due to the de-identified nature of data collected, the study was exempted by the local Human Research Ethics Committee.

2.2 Data Collection and Analysis

A comprehensive review of the RMMR reports conducted by accredited pharmacists was performed by one study investigator (MP). A standardized pro forma was developed in Microsoft Excel to aid data collection. The data extracted included patient demographics, diagnosed medical conditions, current medication profile, pharmacists' recommendations, and GPs' acceptance of pharmacists' recommendations. All medications and diagnoses were coded as per the Anatomical Therapeutic Chemical (ATC) classification system [18] and the International Classification of Disease, 10^{th} revision (ICD-10) [19], respectively.

2.3 Medication Assessment

Each resident's medication regimen complexity was computed using the 65-item validated MRCI, developed by George et al. [9]. The MRCI provides scores for dosage forms, dosing frequencies, and additional directions. Higher MRCI scores reflect more complex regimens. Both the prescribed and over-the-counter medications taken by the residents were reviewed and scored based on the MRCI. The MRCI scores were determined at three different time points: at baseline, post-RMMR (with the assumption that all of the pharmacists' recommendations were taken up by the GPs), and post-GP actual uptake of the pharmacists' recommendations.

2.4 Recommendation Assessment Criteria

The accredited pharmacists' recommendations were categorised as those that:

(i) Decreased the MRCI score.

(ii) Increased the MRCI score.

(iii) Did not change the MRCI score.

2.5 Statistical Analysis

Data was analysed using Microsoft Excel and IBM SPSS Statistics for Windows, Version 20.0 (Armok. NY: IBMCrop). A total number of 285 residents' MRCI scores were computed at baseline, post-RMMR, and post-GP uptake of pharmacists' recommendations.

The change in MRCI score before and after the RMMR, (i) assuming that all of the pharmacists' recommendations were accepted by the GPs and (ii) based on the actual GP acceptance of pharmacists' recommendations, were compared using 2-tailed Wilcoxon signed rank tests ($P<0.05$).

3 Results

Table 1 presents the baseline characteristics of the residents. The mean (standard deviation (SD)) age was 85.5 (7.7) years and 68% (n=193) of the residents were female. At baseline, the mean (SD) number of medical conditions was 6.8 (2.6) and the mean (SD) number of medications was 8.8 (3.3). Diseases of the circulatory system were the most common medical conditions (n=389, 20.2%) and the most frequently prescribed class of medication was that pertaining to the nervous system (n=706, 28.2%).

3.1 Medication Regimen Complexity Index

The median MRCI (interquartile range (IQR)) at baseline in the study sample was 25.5 (19.0-32.5). The main contributing factor to the MRCI score was dosing frequency with a median (IQR) of 12.0 (8.5-16.0), followed by additional

directions 8.0 (5.0-10.0), and dosage forms 5.0 (3.0-8.0). The most prevalent dosing frequency for all medications was once daily dosing (1348 medications, 53.8%), the most prevalent dosage form was oral (2069 medications, 83.8%), followed by topical (127 medications, 5.1%), and the most prevalent additional direction was to take at specific time/s (1129 medications, 51%). Table 2 shows the sections of the MRCI and the median values.

Overall, there were no significant differences in the MRCI scores after pharmacists' recommendations (P=0.53) or after GPs' acceptance of these recommendations (p=0.07) compared to the baseline MRCI scores (Table 2). The almost statistically significant latter finding indicated a trend towards GPs implementing more suggested changes that did reduce the medication complexity. A further breakdown of the MRCI scores show that for section A (Dosage forms) pharmacists' recommendations during the RMMR and following GPs' acceptance of the recommendations resulted in a significant increase, whilst section C (Additional directions) showed a significant decrease following pharmacists' recommendations and GPs' acceptance of the recommendations ($p<0.001$).

3.2 Number and types of recommendations

Pharmacists made a total number of 764 recommendations (average 2.7 recommendations per RMMR), 74.5% (n=569) of which were accepted by GPs. Overall, 29% (n=222) of pharmacists' recommendations resulted in an increase in the MRCI score whilst 30% (n=229) resulted in a decrease in the MRCI score. A total of 313 (41%) recommendations did not affect MRCI score. These latter recommendations pertained to monitoring of laboratory or clinical indices, such as blood pressure.

4 Discussion

To our knowledge, this is the first study that has evaluated the impact of RMMRs on simplifying medication regimen complexity in Australian ACF residents by using the MRCI. The results of our study showed that although nearly three-quarters (74.5%) of the recommendations made by the pharmacists were accepted by the GPs, no significant reduction in the complexity of medication regimens resulted from pharmacists' recommendations and GP uptake of these recommendations.

Our study found that only 30% of the pharmacists' recommendations reduced the MRCI score. Review of the RMMR reports showed that the pharmacists' recommendations were justifiably often directed towards dose optimisation, reduction of side effects, monitoring for drug complications, patients' physical ability to take medications and ways to ease medication consumption. However, these recommendations did not necessarily reduce the MRCI score. For example, the suggestion to change vitamin D tablet once daily to vitamin D liquid once weekly, may seem to make it easier for the patient to take the medication but actually increases MRCI score by 2 points as a result of changing the tablet (score=1) to liquid (score=2) form and the frequency from once daily (score=1) to a less frequent (score=2) once weekly regimen. Furthermore, in ACFs, nurses are generally responsible for administering medications to the residents and the pharmacists may thus not see the value in reducing the medication regimen complexity for these patients. The importance of reducing complexity may also have been underestimated by pharmacists for patients who used dose administration aids (DAAs). A study by Elliot et al. [20] showed that pharmacists did not simplify medication regimen complexity for patients who were discharged to an ACF or using a DAA after discharge. When medication regimens are simplified, less time is spent for administration of medications by nurses and the prevalence of medication errors is lowered [14]. Thus, it is important for the pharmacist to be mindful of the significance of simplifying medication administration when conducting RMMRs by being aware of medication regimen complexity.

Factors that can reduce medication regimen complexity include use of combination medications, long-acting formulations as an alternative to multiple daily dosing, lower strength doses instead of splitting of tablets [22], or the deprescribing of preventative medications such as statins, bisphosphonates wherever relevant [23, 24]. We suggest further education of pharmacists to enhance understanding of these factors. The importance of pharmacist training regarding medication regimen simplification has also been suggested by Advinha et al. [13]. A study by Elliott [24] showed that it was feasible to achieve the goal of medication regimen simplification by training pharmacists and this could be greatly enhanced with doctors' cooperation. Education of doctors in conjunction with pharmacists was significant as it was found that 63% of the recommended changes to reduce medication regimen complexity were successfully implemented. Further studies examining the effectiveness of educational modules for pharmacists and GPs in reducing medication regimen complexity and achieving associated clinical outcomes following RMMRs in ACFs are warranted.

The mean (SD) baseline MRCI in our study was 26.0 (9.8). This figure was higher compared to a previous study conducted on institutionalized elderly people which had a mean (SD) MRCI of 18.2 (9.6) [13]. In contrast, the median MRCI (43.5) of the study by Herson et al. [14] on residents of long-term ACFs was significantly higher than our study (25.5). In the study by Herson et al. [14], the proportion of diseases (e.g. cardiovascular system and diabetes) requiring combinations of different treatments and using medications with high MRCI score (e.g. prefilled injection has a score of 3) was significantly higher than our study. The mean (SD) MRCI score for elderly discharged from hospital was reported as 30.3 (14.0) [10]. The score could be higher because recently discharged people often were diagnosed with new conditions and prescribed new medications. The mean (SD) MRCI score of elderly patients in older home care patients was 35.4 (22.4) [25], considerably higher than our results. This could be related to the higher number of prescribed medications than our study, as the number of medications is one of the components of MRCI.

In agreement with our results, Advinha et al. [13] found that dose frequency was the main contributor in increasing the MRCI score. Our study showed an increase in the section B score after pharmacists' recommendations and after GP uptake of recommendations, however this did not reach statistical significance. Herson et al. [14] showed that once daily dosing was the most frequent dosing frequency (54.6%) which was consistent with our results (53.8%). In our study the most prevalent dosage form was oral forms (83.8%), followed by topical forms (5.1%) which were in line with the findings of Advinha et al. [13] - oral forms (90.5%) and topical forms (4.1%) and Herson et al. [14] - oral tablet/capsules (70.4%) and topical creams, gels, paints and patches (8.6%). The higher percentage of oral forms in our study in comparison with Herson et al. [14] could be explained by the inclusion of other oral dosage forms in addition to tablets/capsules (liquids, lozenges, or powders/sachets) in our study.

In Australian ACFs, inappropriate prescribing is not uncommon [26]. The RMMR was designed to enhance the quality use of medicines and reduce ADEs for permanent residents of Australian ACFs [15]. A recent Australian literature review showed that pharmacists were concentrating on many aspects of medication management during medication reviews such as compliance, inappropriate drug selection, and additional monitoring to detect or prevent adverse reactions [27]. A successful reduction in prescribing of sedative and anticholinergic medications was reported following pharmacist conducted RMMRs [28] and a retrospective study involving 62 ACFs revealed that RMMRs were able to identify over 96% of drug related problems in the residents [16]. In our study, pharmacists made a total of 764 recommendations by conducting RMMRs. Although these may not have necessarily reduced medication regimen complexity, the fact that the majority of these were accepted by GPs suggested that the recommendations were appropriate in improving the residents' quality of life by addressing potential drug-related problems.

4.1 Limitations

This was a retrospective study and although GPs noted that they would consider some recommendations pending other factors such as laboratory results, it is unknown to what extent these recommendations had been implemented by GPs, resulting in further change in MRCI.

Additionally, the RMMR data collected was performed by accredited pharmacists, all of whom were associated with one RMMR service provider, and the results may not be generalised to other RMMR service providers and accredited pharmacists nationally. Finally, similar to the study by Herson el at. [14], our study also used an MRCI tool which has not been validated for use in ACFs.

5 Conclusion

Accredited pharmacists can use the MRCI to identify older people with complex medication regimens. Our study failed to show significant benefit of RMMRs in reducing the medication regimen complexity as measured by the MRCI. Further studies are needed to establish the association of MRCI and clinical outcomes in residents of ACFs. However, the study revealed that RMMRs are useful for identifying and resolving drug-related issues among residents of ACFs.

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Table 1 Baseline characteristics of the study sample (n=285)

Characteristics	**Value**
Age, Y, Mean (SD)	85.6 (7.7)
Sex, n (%)	
Female	193(67.7)
Male	92(32.3)
Medical conditions per patient [mean (SD)]	6.8(2.6)
Top 5 medical conditions [number (%)]	
Diseases of the circulatory system	389(20.2)
Mental and behavioural disorders	299(15.5)
Diseases of the musculoskeletal system and connective tissue	241(12.5)
Endocrine, nutritional and metabolic diseases	148(7.7)
Diseases of the nervous system	124(6.5)
Medications per patient [mean (SD)]	8.8 (3.3)
Regular prescription medication, [mean (SD)]	7.2 (2.9)
"When required" medications [mean (SD)]	1.6(1.4)
Top five medication classes [number (%)]	
Nervous system	706(28.2)
Alimentary tract and metabolism	686(27.4)
Cardiovascular system	448(17.9)
Blood and blood forming organs	208(8.3)
Sensory organs	107(4.3)

Table 2 Medication Regimen Complexity Index score at baseline, post-RMMRs, and after GPs' considerations of pharmacist's recommendations

MRCI score	**Median (IQR)**	**Mean (SD)**	**MRCI score**	**Median (IQR)**	**Mean (SD)**	**P-value**	**MRCI score**	**Median (IQR)**	**Mean (SD)**	**P-value**
MRCI score baseline	25.5 (19.0-32.5)	26.0(9.8)	**MRCI score post-RMMRs**	25.0 (19.0-33.5)	25.9 (9.7)	0.526	**MRCI score post-GP uptake**	25.0 (19.0-33.0)	25.8 (9.7)	0.069
Section-A Dosage Forms MRCI score baseline	5.0 (3.0-8.0)	5.7 (4.0)	Section-A Dosage Forms MRCI score post-RMMRs	5.0 (3.0-8.0)	6.1 (4.1)	<0.001*	Section-A Dosage Forms MRCI score post-GP uptake	5.0 (3.0-8.0)	5.8 (4.0)	0.024*
Section-B Dosing Frequency MRCI score baseline	12.0 (8.5-16.0)	12.4(5.0)	Section-B Dosing Frequency MRCI score post-RMMRs	12.5 (9.0-15.7)	12.4 (4.8)	0.694	Section-B Dosing Frequency MRCI score post-GP uptake	12.5 (8.7-15.5)	12.4 (4.9)	0.385
Section-C Additional Directions MRCI score baseline	8.0 (5.0-10.0)	7.9 (3.5)	Section-C Additional Directions MRCI score post-RMMRs	7.0 (5.0-10.0)	7.4 (3.3)	<0.001*	Section-C Additional Directions MRCI score post-GP uptake	7.0 (5.0-10.0)	7.6 (3.4)	<0.001*

*Significant at P<0.05